

WHAT IS CLAIMED IS:

1. A method of producing an apparatus with a carbon nanotube tip, the method comprising:
providing a first substrate having a first surface with a plurality of precursor tips;
growing a carbon nanotube tip on substantially all of the precursor tips; and
limiting the growth of substantially all of the carbon nanotube tips to a predetermined
5 maximum length.
2. The method of claim 1, further comprising separating a carbon nanotube tip from other carbon nanotube tips.
3. The method of claim 1, wherein each precursor tip is supported on an atomic force microscopy cantilever.
- 10 4. The method of claim 1, further comprising providing a second substrate having a second surface at a distance from and facing the first surface of the first substrate.
5. The method of claim 4, wherein the second substrate is conductive.
6. The method of claim 5, further comprising applying an electrical potential between the second surface and ends of the carbon nanotubes that are distal to the precursor tips.
- 15 7. The method of claim 4, further comprising cleaving ends of the carbon nanotubes that are distal to the precursor tips from the second surface of the second substrate.
8. The method of claim 4, wherein the distance between the second surface and the first surface is substantially constant.
9. The method of claim 4, wherein the distance between the second surface and the first
20 surface varies.
10. The method of claim 4, further comprising shortening substantially all of the carbon nanotube tips to a desired length.

11. The method of claim 10, wherein the desired length is between about 5 nanometers and about 500 micrometers.
12. The method of claim 10, wherein the desired length is between about 5 nanometers and about 50 micrometers.
- 5 13. The method of claim 10, wherein the desired length is between about 5 nanometers and about 5 micrometers.
14. The method of claim 10, wherein the desired length is between about 100 nanometers and about 500 micrometers.
15. The method of claim 10, wherein the desired length is between about 100 nanometers and
10 50 micrometers.
16. The method of claim 10, wherein the desired length is between about 100 nanometers and 5 micrometers.
17. The method of claim 10, wherein the desired length is between about 500 nanometers and about 500 micrometers.
- 15 18. The method of claim 10, wherein the desired length is between about 500 nanometers and 50 micrometers.
19. The method of claim 10, wherein the desired length is between about 500 nanometers and 5 micrometers.
20. The method of claim 10, wherein the desired length is between about 3 micrometers and
20 5 micrometers.
21. A method of producing a plurality of apparatuses having carbon nanotube tips, the method comprising:

providing a first substrate having a first surface with a plurality of precursor tips;
providing a second substrate having a second surface facing the first surface;
growing a carbon nanotube tip on substantially all of the precursor tips; and
applying an electrical potential between the second surface and ends of the carbon

5 nanotubes that are distal to the precursor tips.

22. A method of producing an apparatus with a carbon nanotube atomic force microscopy tip,
the method comprising:

providing a first substrate having a first surface with a plurality of cantilevers having
catalyst islands;

10 growing a carbon nanotube tip on substantially all of the catalyst islands; and

limiting the growth of substantially all of the carbon nanotube tips to a predetermined
maximum length.

23. The method of claim 22, further comprising separating a carbon nanotube atomic force
microscopy tip from other carbon nanotube atomic force microscopy tips.

15

24. The method of claim 22, further comprising providing a second substrate having a second
surface at a distance from and facing the first surface of the first substrate.

25. The method of claim 24, wherein the second substrate is conductive.

20

26. The method of claim 25, further comprising applying an electrical potential between the
second surface and ends of the carbon nanotubes that are distal to the precursor tips.

27. The method of claim 24, further comprising cleaving ends of the carbon nanotubes that
25 are distal to the precursor tips from the second surface of the second substrate.

28. The method of claim 24, wherein the distance between the second surface and the first
surface is constant.

29. The method of claim 24, wherein the distance between the second surface and the first surface varies.

30. The method of claim 22, further comprising shortening substantially all of the carbon
5 nanotube tips to a desired length.

31. The method of claim 30, wherein the desired length is between about 5 nanometers and about 500 micrometers.

32. The method of claim 30, wherein the desired length is between about 5 nanometers and about 50 micrometers.

10 33. The method of claim 30, wherein the desired length is between about 5 nanometers and about 5 micrometers.

34. The method of claim 30, wherein the desired length is between about 100 nanometers and about 500 micrometers.

15 35. The method of claim 30, wherein the desired length is between about 100 nanometers and 50 micrometers.

36. The method of claim 30, wherein the desired length is between about 100 nanometers and 5 micrometers.

37. The method of claim 30, wherein the desired length is between about 500 nanometers and about 500 micrometers.

20 38. The method of claim 30, wherein the desired length is between about 500 nanometers and 50 micrometers.

39. The method of claim 30, wherein the desired length is between about 500 nanometers and 5 micrometers.

40. The method of claim 30, wherein the desired length is between about 3 micrometers and 5 micrometers.

41. A method of producing an apparatus with a nanostructure tip, the method comprising:
5 providing a first substrate having a first surface with a plurality of precursor tips;
 growing a nanostructure tip on substantially all of the precursor tips; and
 limiting the growth of substantially all of the nanostructure tips to a predetermined
 maximum length.

42. The method of claim 41, further comprising separating a nanostructure tip from other
10 nanostructure tips.

43. The method of claim 41, wherein the precursor tips are supported on an atomic force
 microscopy cantilever.

44. The method of claim 41, further comprising providing a second substrate having a second
 surface at a distance from and facing the first surface of the first substrate.

45. The method of claim 44, wherein the second substrate is conductive.

46. The method of claim 45, further comprising applying an electrical potential between the
 second surface and ends of the nanostructures that are distal to the precursor tips.

47. The method of claim 44, further comprising cleaving ends of the nanostructures that are
 distal to the precursor tips from the second surface of the second substrate.

48. The method of claim 44, wherein the distance between the second surface and the first
20 surface is substantially constant.

49. The method of claim 44, wherein the distance between the second surface and the first
 surface varies.

50. The method of claim 44, further comprising shortening substantially all of the nanostructure tips to a desired length.

51. The method of claim 41, wherein the nanostructures are carbon nanostructures.

52. The method of claim 41, wherein the nanostructures are cobalt oxide nanostructures.

5 53. The method of claim 41, wherein the nanostructures are nanotubes.

54. The method of claim 41, wherein the nanostructures are nanowires.

55. The method of claim 41, wherein the nanostructures are nanofibers.

56. A method of producing a plurality of apparatuses having nanostructure tips, the method comprising:

10 providing a first substrate having a first surface with a plurality of precursor tips;
 providing a second substrate having a second surface facing the first surface;
 growing a nanostructure tip on substantially all of the precursor tips; and
 applying an electrical potential between the second surface and ends of the
 nanostructures that are distal to the precursor tips.

15 57. The method of claim 56, wherein the nanostructures are carbon nanostructures.

58. The method of claim 56, wherein the nanostructures are nanotubes.

59. The method of claim 56, wherein the nanostructures are nanowires.

60. The method of claim 56, wherein the nanostructures are nanofibers.

61. A method of producing an apparatus with a nanostructure atomic force microscopy tip,
20 the method comprising:

 providing a first substrate having a first surface with a plurality of cantilevers having
 catalyst islands;

growing a nanostructure tip on substantially all of the catalyst islands; and
limiting the growth of substantially all of the nanostructure tips to a predetermined
maximum length.

62. The method of claim 61, further comprising separating a nanostructure atomic force
5 microscopy tip from other nanostructure atomic force microscopy tips.

63. The method of claim 61, further comprising providing a second substrate having a second
surface at a distance from and facing the first surface of the first substrate.

10 64. The method of claim 63, wherein the second substrate is conductive.

65. The method of claim 64, further comprising applying an electrical potential between the
second surface and ends of the nanostructures that are distal to the precursor tips.

15 66. The method of claim 61, further comprising cleaving ends of the nanostructures that are
distal to the precursor tips from the second surface of the second substrate.

67. The method of claim 63, wherein the distance between the second surface and the first
surface is constant.

20 68. The method of claim 63, wherein the distance between the second surface and the first
surface varies.

25 69. The method of claim 61, further comprising shortening substantially all of the
nanostructure tips to a desired length.

70. The method of claim 61, wherein the nanostructures are carbon nanostructures.

71. The method of claim 61, wherein the nanostructures are nanotubes.

30 72. The method of claim 61, wherein the nanostructures are nanowires.

73. The method of claim 61, wherein the nanostructures are nanofibers.